TECHNOLOGY, PLANNING

AND

THE STATE OF MINNESOTA

Report of a Seminar and Summer Study Group
in the Center for Urban and Regional Affairs
University of Minnesota

October 1970

Sponsored by

THE MINNESOTA STATE PLANNING AGENCY

Health and Natural Resources
Planning Groups

The work upon which this publication is based was supported in part by funds provided by Federal grants from the Department of Health, Education, and Welfare and the Department of Housing and Urban Development.

FOREWORD

This report results from a seminar and summer study organized through the University of Minnesota, Center for Urban and Regional Affairs, and supported cooperatively by the Minnesota State Planning Agency's Health and Natural Resources Planning Groups. The seminar was called the Environmental Management Study Group. It included faculty members and students from several departments and collegiate units of the University. During the summer of 1970, a small study group considered the results and implications of the seminar, gathered other information, drafted recommendations, and prepared this report.

The report was prepared under the direction of Professor Dean Abrahamson, with the assistance of Dr. Donald Geesaman, Mark Heitlinger, and Steven Emmings. An advisory committee of seminar members also reviewed the manuscript and met periodically with Dr. Abrahamson and the study group.

The seminar concluded that deterioration of man's environment is the result of application of technologies of ever-growing scale, complexity, and intensity. The issues surrounding this conclusion are deep and many-sided, and the members of the seminar spent much time exploring and discussing them, each from the view of his own branch of science and his personal experience.

Two major needs seemed to appear repeatedly to the seminar study group as it sifted the information which the seminar had explored and debated: (1) the need for much more data, accurate and quickly available; and (2) the need for full and dispassionate assessment of the impact of technology on the environment.

This report emphasizes those needs and makes recommendations to meet them. The report merits most serious consideration in Minnesota's tradition for full discussion of issues and constant search for better means to manage its public affairs.

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SECTION ONE

INTRODUCTION AND HISTORY

SECTION ONE

INTRODUCTION

In considering the history of Minnesotans' treatment of their natural resources, briefly summarized in Section One of this report, and some environmental problems of current interest, we are lead to the conclusion that promotional bias dominates the information on which societal decisions are made; that the time scale for promotion, decision and implementation is frequently short compared with that of secondary effects of the decision; that the basis for assessment has been a narrow economic one avoiding the external costs; and that basic information on which to base a broader assessment has either been lacking or inaccessible.

This may suggest to some that there can be only apocalyptic or revolutionary solutions. We suggest that there are steps which

can be taken which address the deficiencies outlined above, which are minimally disruptive, which are accessible, and which fit naturally within the charters of existing institutions.

The first recommendation is for the recognition of a new university responsibility to prepare arguments on the inadvertent consequences of new or expanding technologies. This recommendation is presented and discussed in Section Two of this report.

The second recommendation is presented as a proposal for the establishment of a system of data banks coordinated by the Minnesota State Planning Agency. This proposal, which includes the recommendation for legislation requiring mandatory disclosure of all wastes emitted to the environment, comprises Section Three of this report.

The proposals are designed to enable a consideration of the long-range effects and extent of influence of existing and new technologies on our State's economic and social goals and on its environmental quality; to identify alternatives to proposed technological developments or regulation of technology; and to assure a systematic and thorough collection of data relating to the environment.

Section Four of the report contains a brief description of the Environmental Management Study Group and abstracts of the resulting papers. These papers have been submitted with this report and are on file at the Minnesota State Planning Agency.

Environmental problems, including those caused by pollution, are of interest from two viewpoints. Some people consider pollution primarily as a direct hazard to man. Others recognize that toxicity to humans is but one aspect of the pollution problem, the other being

a threat to the maintenance of a biosphere suitable for life as we know it. The first viewpoint leads to emphasis on human food chains; the second leads to emphasis on human welfare insofar as it depends on the integrity of the diverse ecosystems of the earth, the living systems that appear to have built and now maintain the biosphere.

These viewpoints are not, however, dichotomous. The director of the National Institute of Environmental Health Sciences has predicted that 80 to 90 percent of the disorders which will confront physicians now being trained will be environmentally related.[1] It has recently been estimated that a 50 percent reduction in air pollution levels in major urban areas would lead to an annual savings of over two billion dollars in terms of decreased morbidity and mortality.[2] A current report, prepared by a group organized by the Department of Health, Education, and Welfare, as part of an effort to develop a national health policy, estimates the cost of environmentally induced disease at 38 billion dollars a year.[3] Human health seems clearly proportional to environmental health or at least tightly coupled with today's pollution problems.

This report, and the proposals made within it, has no pretensions of presenting exhaustive solutions to, or complete documentation of, the environmental health problems which have become

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[1] Environmental Science and Technology, Vol.4, pp. 275-277, April 1970

[2] L.B. Lave & E.P. Seskin, Science, Vol. 169, pp. 723-733, 21 Aug 1970

[3] Environmental Health Letter, Vol. 9, p. 1, 15 September 1970

so apparent in recent years. What it does purport to do is to suggest steps designed to correct defects in our society's ability to anticipate the consequences of its decisions.

THE CHANGING FACE OF MINNESOTA

Environments change incessantly. The operation of geological and biological forces has continually altered the appearance of the earth for well over a billion years. During the last few hundred years, however, the activities of man have created major alterations at an unprecedented rate.

Clearly, it is not man's intention to destroy his environment; unproductive land or polluted air are not human goals. Rather, these and other environmental alterations represent the secondary effects of man's exploitation of the earth's resources. Environmental degradation is not exclusively the result of population pressures but rather the result of an increasingly technological society motivated by the acquisition of short-term benefits.

Early man had a significant effect upon his environment. Migrations of Asiatics into North America coincide with the extinctions of many species of mammals. One theory holds that prehistoric hunting and the increased incidence of fire associated with man are responsible for their disappearance. In Minnesota, early white settlers found Indians successfully engaged in farming, extracting minerals, and systematically burning prairie and savanna as a form of land management.

The first white settlers found the land to be productive and abundant in resources. Wildlife, valuable for flesh and fur, was

plentiful. Rich prairie soil stretched to the south and west. Of the forty-eight contiguous states, only Texas exceeded Minnesota in the extent of its original forested area. Finally, the state held one of the largest and richest iron ore deposits in the world.

This sleeping wealth presented a challenge: How could Minnesota attract labor and capital to develop its resources? The people of Minnesota embarked on a program of massive advertising campaigns, subsidies and land grants to solve this problem. Below, a handbill characteristic of the times may be seen:

MINNESOTA!

CURE FOR THE PANIC

Emigrate to Minnesota!

Where no Banks exist; a supension is unknown. Land and Water of best kind. No Ague and Fever there. CLAIMS can be made by rich and poor.

THE MAN OF SMALL MEANS

CAN SOON REACH COMPETENCY.

Climate dry and healthy. The rich respect and assist the poor—all labor together. The finest Lands are open to pre-emption.

Saint Paul is the great stopping place,

From there you can go to any point, as emigrant settlers start daily to the various Land Offices and Districts.

T. B. W.

Thos. E. Scrror, Printer, 142 Fulton Street, New York.

Resources were so abundant that they appeared to be inexhaustible; the stage was set for exploitation.

In agriculture, advertising and liberal land policies created phenomenal growth. Immigration agents were established in New York and Scandinavia, and Civil War veterans were offered free land. In 1850, there were 157 farms and the state's population was 4,000; by 1860, there were 18,000 new farms and a population of 172,000; and by 1900, the state had 136,000 new farms and a population of 1,751,000.

State wildlife was assaulted by fur trappers, market hunters, and members of exclusive hunting clubs. Further, the growth of agriculture destroyed natural habitat. Bison, elk and caribou completely disappeared; moose and beaver populations were decimated in the early 1900's; wolverine and marten were eliminated by 1922; and many species of birds were hunted to extinction.

In forestry, Minnesota's story is familiar. As forests fell, the lumber industry moved west sweeping its way through state after state reaching Minnesota in about 1820. Areas which were logged over were left strewn with debris which constituted great fire hazards. The era from 1894 to 1917 was marked by great fires which burned over millions of acres, some towns, and killed many hundreds of people.

Minnesota's deposits of iron ore were also exploited. By 1890, the state's 184 incorporated mining companies were extracting great quantities of ore, and the vast and rich Masabi range had not yet been touched. By the early 1900's, rich ores were growing scarce and efforts were being made to utilize leaner deposits.

The 19th century efforts to attract labor and capital to the state were highly successful. In the haste to develop Minnesota's natural wealth many resources were poorly managed. By 1910, Minnesota's continuing productivity had become a major concern.

At first, Minnesotans were incredulous. The illusion of inexhaustible resources was stripped away and it was realized that steps to preserve resources had to be taken. Agricultural productivity was improved through drainage of wetlands, a shift in the crop/livestock system, and more recently, by the introduction of disease resistant and early maturing varieties, mechanization, and synthetic fertilizers and pesticides. Continued timber production was insured by fire protection, insect and disease control, reforestation, and improved cutting practices. The production of iron ore has been maintained only through the use of concentrating processes.

So the productivity of Minnesota's lands, forests and mines was maintained and even improved in some cases. But the solution created new problems. Drainage of wetlands destroyed waterfowl habitat, lowered the water table, and increased siltation and run-off. Pesticides have been responsible for fish and bird kills, and the level of pesticides is rising in foods. Synthetic fertilizers have contaminated ground water and pose pollution threats to lakes and streams. Complete forest fire protection is not always desirable; it has been found that fire is essential to the production of some forest types. Finally, taconite plants have created great controversy over their waste management practices.

A marked trend toward urbanization began in about 1920 precipitating new environmental and social conditions. The Minneapolis-St.Paul metropolitan area has become the population center of Minnesota and has serious transportation and air pollution problems. A recent Metropolitan Council report, before editing, commented on the conditions in the downtown area:

> In the past year or so we have witnessed winter white-outs and summer pollution fogs that obscure 20-30 story buildings from people a half mile away. Automobile windshields at the end of the work day are often covered with a fine layer of black substance. Downtown street noises at times make any attempt at outdoor conversation a futile effort. Last and probably most annoying of all is the occasionally strong stench of diverse origin that moves in on the morning breeze to greet the Downtown worker and visitor.[1]

It is noteworthy that few data seem to be available on the trends exhibited by the conditions noted in this draft report.

In spite of this history of difficulties, essentially uncontrolled expansion is encouraged not only in the metropolitan area but in other portions of Minnesota as well with no advance statement of new problems which will result and new regulations which should precede or possibly limit new developments. Few are unaware of the efforts to establish a copper-nickel mining and smelting industry in Northern Minnesota. This, as well as other such development efforts, is characterized by a heavy promotional bias during the decision-making process, a narrow economic basis for assessment, and a time scale for decision-making and implementation which

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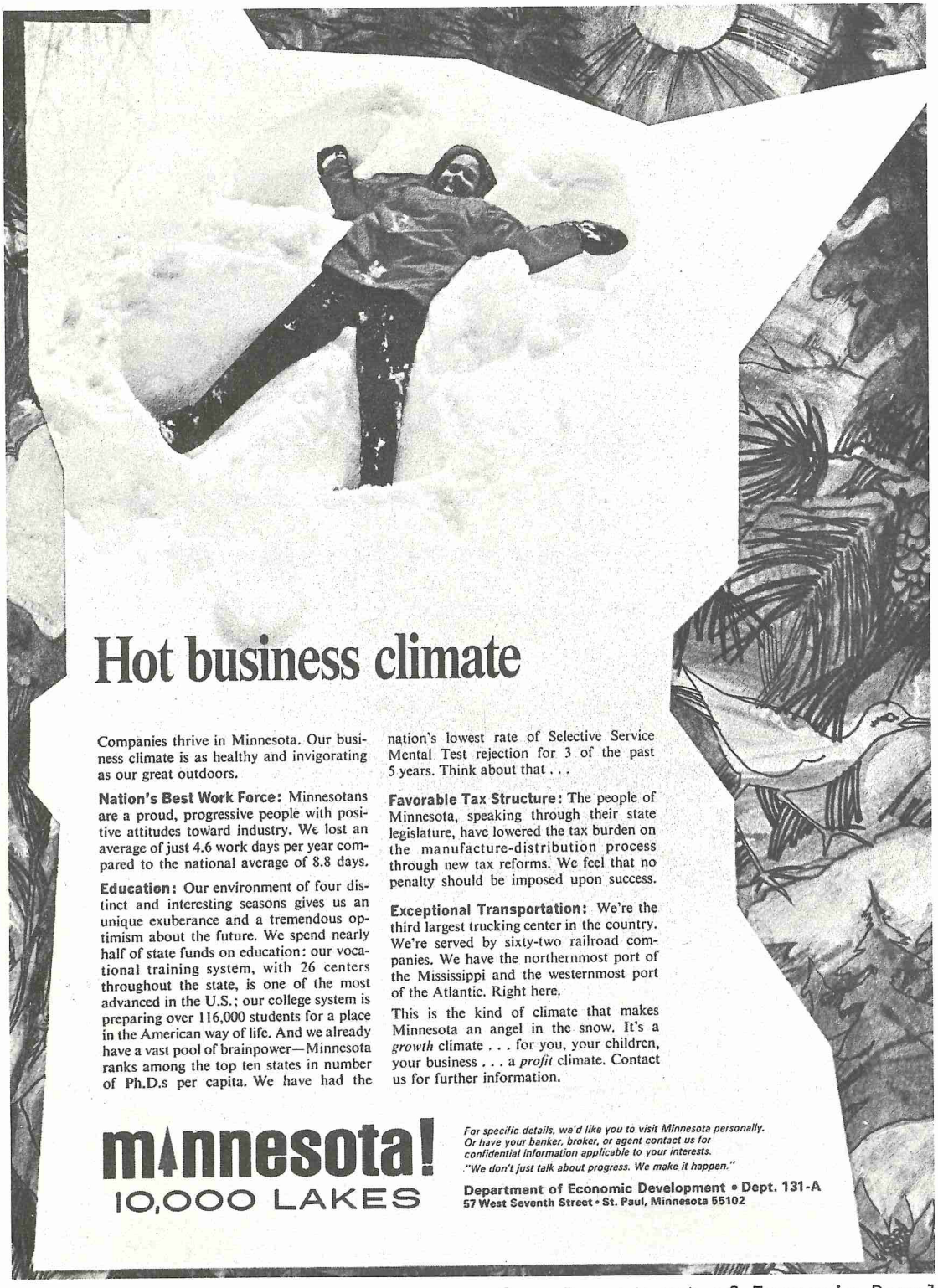
[1] Minneapolis Star, Aug. 21, 1970, p. 2B.

is short compared with the time scale for non-beneficial effects to be manifest. On the latter point we can look to the decision to locate a taconite processing plant on Lake Superior some two decades ago and the evidence regarding harmful effects to the Lake which is only now being recognized.

The enthusiasm for expansion without regard for long-term effects is a modern manifestation of the exploitive attitude which characterized early resource development in Minnesota. A report by the Minnnesota Natural Resource Council entitled *Natural Resources of Minnesota: 1962*, epitomizes the attitude of effusive optimism and enthusiasm regarding resource development. This report was written on the premises that Minnesota has an "abundance of natural resources" ("oceans" of water and "amazing" soils) and that the subject of natural resources should be approached "within the framework of a comprehensive program for the development of all resources." The report labels the past era of resource exploitation a "Golden Age," and it assures the reader that this era has not ended, only changed. It goes on to say that although the early notion of inexhaustible resources has proven to be a myth, the State has no problem because its "renewable resources are being re-stocked, substitutes are being found for the others, and man's genius is finding use for those heretofore considered worthless." One is compelled to think that Minnesota is actually better off today, in terms of natural resources, than it was before its resources were exploited; this new myth is really only a slight variation of the old one.

In its search for new industry, the State of Minnesota, through its Department of Economic Development, is acting in a manner reminiscent of the 1800's. An advertisement of 1970, except for style, looks much like one from the past:



--from Department of Economic Development

Today, the emphasis is on human resources, i.e., progressive people and a highly educated and dedicated work force. The State is offering its investment in its people not as a cost but, rather, as part of our endowment. Industry is in fact being assured that it has minimal responsibility in the renewal and maintenance of this valuable resource.

Business growth is not intrinsically undesirable, but neither is it necessarily in the best interests of Minnesota. A 1967 University of Minnesota Agricultural Extension Service report stated:[1]

> We have all heard or observed instances in which a community in its zeal to attract employment and income ignored the impact of such industry. The overloaded waste treatment facility, the polluted stream, the unsightly entrance to the community, the residences subjected to noise, dust, and fumes from an adjacent plant, the dangerous traffic pattern--all are dimensions of the quality problem. Careful advance community planning and action could usually have helped avoid these problems.

It is noteworthy that there is no individual in either the Department of Economic Development nor the Minnesota Pollution Control Agency who has the designated responsibility for liaison with the other agency. A similar situation exists between other state agencies.

We also note that several agency officials espouse the philosophy that anticipatory regulation is either impossible or ridiculous. The practice seems to be to respond rather than to attempt to anticipate in cases ranging from the most far-reaching, such as transportation systems or a new mining industry, to those that are almost trivial, such as the growing number of all-terrain vehicles.

The trend toward a high degree of technology began to be evident following World War II. Although these changes were associated with an increase in population, it is clear that population growth alone cannot explain the decline in environmental quality.

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[1] R. D. Vlasin, "National Economic Trends and the Implications for Minnesota," Proc. Resource Development Workshop for State Leaders, May 1967, Minn. Ag. Ext. Service, Univ. of Minn.

Consumption of natural resources and energy is growing at a rate many times faster than population. At the same time, the long-promised "technological fix" has failed to materialize.

Waste management problems associated with increased urbanization and industrialization have compounded the problem of maintaining environmental quality. The rapid creation and widespread distribution and use of the products of modern technology (such as plastics, radioactive energy, automobiles, and synthetic fibers) has created a new and very serious set of pollution problems. As with the original assault upon Minnesota's natural resources in the 19th century, urbanization, industrialization, and the development of new technologies have been greeted with a wealth of enthusiasm and a dearth of penetrating analysis.

SECTION TWO

PROPOSAL ON TECHNOLOGY ASSESSMENT IN SOCIETY

ABSTRACT

This proposal is based on the following premises: that change in our society is dominated by technology; that no institutions exist within our society to consistently anticipate the secondary implications of technology; that, in fact, the present promotional process is operationally biased away from the consideration of secondary and detrimental effects; and finally, that in a society, increasingly circumscribed by diminished space, resources, and individual privacy, this situation constitutes a serious defect. Specifically, a new University responsibility is proposed to be fulfilled by one or more multidisciplinary groups of eight to twelve people, chosen by the University President from University staff, and given the explicit responsibility to prepare public adversary arguments on some technologies which in their judgment have substantial relevance to the natural and social future of the state. It is assumed that the representatives of the technologies can be reasonably expected to provide public descriptions of the benefits incident to the technology in question. The proposal in no way expresses an opposition to technology, per se; rather, it is conceived as a mechanism to enhance and guarantee the desirability of any specific technology.

INTRODUCTION

In our highly ordered society, large scale change comes quickly and is dominated by technology. It is to the advantage of a state to anticipate the secondary implications of change in order that adverse effects to society and the natural world can be avoided or minimized. Present assessments of technological change are based on the economic market criteria of private innovators or on the fragmentary and diverse judgments peculiar to the special interests of professional groups and governmental agencies. In each case, the point of view is narrow, unitary, and self-interested; and the time interval of concern is artifically short, reflecting the time scales natural to corporate and governmental function.

Obviously, narrow bases of assessment ignore many secondary implications along with the segments of society involved by these implications. External costs are neglected, and consequent diseconomies can result to the net detriment of society. An electric utility company in deciding whether to install a new power plant treats the production and sale of the additional electricity as the prime objective. It considers the fossil fuel burned in producing the power as a cost, but neglects the economic implications of discharging the resulting combustion wastes into

the atmosphere. Damage to health and property caused by these wastes does not appear in the utility's accounting and instead becomes an external cost borne by the contiguous community.

By appropriate technology, the quality of the discharged wastes can be improved, and the price is often demonstrably small compared to the reduction in internal cost. The installation of additional equipment is an external cost of the utility and can reasonably be passed on to the users by a rate increase, but this in turn will prejudice the desirability of electricity in the overall energy market. So long as such decisions derive from a narrow economic base, utilities will not voluntarily increase internal costs, and diseconomies will be inevitable.

Generating plants are conspicuous. The electric power industry is large and conjectured to grow much larger. Mainly for these reasons, utility operations have invited scrutiny and concern. In fact, utilities are only typical and symptomatic, and many other industries and bureaucracies are vulnerable to similar comment.

Minnesotans might wonder whether the proven property damage from salt use on winter streets is not substantially greater than the expense of alternative methods of street clearing. In this instance, it is a governmental agency that chooses the technology. There is little doubt but that the decision for salt is made because it fulfills agency responsbilities with the least debit to agency accounts. It is unlikely that third party interests are significantly considered even though much of the damage due to salt can be adequately documented.

More commonly, the external costs defy quantification and appear as a debt of uncertainty based on unproven damage to health, property or a way of life. Consider the health uncertainties associated with small amounts of cyclamates in diet when larger amounts of the food additive have a proven carcinogenic and tetragenic potential. Consider gasoline engines and the harassment from their ubiquitous noise. Consider information storage and retrieval and the suspected implications it has to our ideas of privacy, freedom and individuality. Consider the speculative effect on lake shore property if Lake Superior were to be polluted by industrial wastes. It is not difficult to find examples.

Where economics are the bases for technological decision, the benefits and detriments often appear in different ledgers. In the case of the SST, the airframe industry and the Federal Aviation Agency promote the SST and would benefit from its development, as would the limited sector of the population who spend appreciable time in air travel; the remainder would subsidize the program and receive only sensory abuse as compensation. If the decision is based on economic factors, then only the first two parties are economically involved and can legitimately influence the decision. The man who is neither promoter nor market has no weight in the primary calculus of decision.

In this asymmetrical situation, the self-interest of the innovator inevitably results in a promotional bias in which the technological benefits are regarded with indelicate optimism, the detriments as the hobgoblins of small minds. The widespread belief that secondary effects are mostly benign and certainly reversible is a dangerous complement of the above.

Similarly, the short time scales legislated by the present bodies of assessment preclude the evaluation of long-term implications. That decisions are primarily made on short-term economic or bureaucratic considerations is a matter of convenience; the indulgence of a rational society so socially diffuse and physically unconfined that such decisions can be treated as being effectively independent of all secondary interactions. This is an indulgence which can no longer be sustained. Witness that in the twenty-five odd years since its innovation enough DDT has been produced and dispersed to lead to significant contamination on a global scale. It was only recognized after the fact that implicit in this contamination were grave biological uncertainties. The size of the earth is no longer an adequate buffer against man's technological potential for physical effect.

As significantly, the time periods required for implementation of society-oriented technology have become small compared with the time periods over which the effects of the technology will be manifest. Twenty million television sets were sold in the United States between 1949 and 1953; the societal effects of the technology will be first expressed over a generation. In the first years after its introduction millions of people took the Sabin polio vaccine contaminated by the sometimes carcinogenic SV-40 virus. The long-term significance of this contamination is unknown, and the uncertainties may only be resolved by the life histories of the exposed.

When early feedback does not occur, any unanticipated detrimental effects will necessarily afflict the entire involved populations. This capacity to totally affect its social and natural

world compels a society to place a premium value on comprehensive foresight. Such foresight is not a functional part of our classical economics, our civil law or the physiology of contemporary bureaucracies, all of which still reflect our society's affection for the freedom to make unrestrained decisions.

To the extent that we stress and saturate our world with technological changes, we must accept constraints on the decisions involving technological change. Because of thermal, combustional and radioactive effluents and the increasing size of individual plants, the decisions affecting power plant siting are more severely constrained than in the past. Technological change has become an expression of human aggressiveness. Accepting the vitality of the species, one can reasonably expect that without substantial restraint and guidance, the physical and biological indeterminacies which correspond to freedom will be ever diminished by technological effects, and we will find ourselves surviving in a barely liveable world--a "spinoff" of man's imaginative powers.

It is no longer in the best interest of our society to avoid an equitable evaluation of the implications of its new technologies. It is further obvious that in a world growing more finite relative to our society's capabilities of technological effect, increasing energies of our society must be allocated to mechanisms which tune technology to the existing natural and social world. Viewed in a larger context, rational thought has limited biological survival value if it cannot function to avoid destructive inconsistencies of self-generated technologies.

Acknowledging these defects does not pass a moral judgment on those institution expressive of the defect. The narrow decisional basis can be recognized as a natural consequence of our belief in an unimpaired freedom of choice coupled with the need for a simple procedure of judgment consistent with institutional purpose. But appreciating this does not preclude a rational criticism that such a procedure leads to socially inefficient diseconomies and a contra-productive disregard for sectors of society that are diffusely coupled to the technology in question by tangible secondary effects.

The short time intervals of intense interest in most present technological evaluations are an obvious derivative of the time natural to corporate and governmental function. Again, it is obvious that some effects attendant on technological change will evolve slowly compared with the pace of corporate clocks. These effects thus appear harmless to the corporate observer, though society may, in fact, judge more severely.

Finally, the promotional bias of technology is accepted as appropriate. It is consistent with our nature and an inevitable demonstration of the enthusiasm necessary for inventiveness. The criticism is that it deprives society of an overall appreciation of alternatives and implications and hence, in the largest sense, is not beneficial without the juxtaposition of some supportive institution with contrary bias.

Accepting all this, the need for a remedial institution is indicated. This institution should compensate for the promotional bias in the assessment of present technological change, and it should

direct public, corporate, and governmental thinking to a broader basis of assessment, one which consistently includes long-term and secondary implications. Furthermore, it should be minimally disruptive of existing institutions. The following proposal describes an institution that hopefully would serve these purposes.

PROPOSAL

A UNIVERSITY COUNCIL ON TECHNOLOGY ASSESSMENT

A new University responsibility is proposed to be fulfilled by one or more multidisciplinary groups of eight to twelve people, chosen by the University President from the University staff, and given the explicit and abstract responsibility to present an effective adversary position on the implications of some technologies, old or new, which in their judgment have substantial relevance to the natural and social future of the State. For such a technology, the adversary position would have effective realization as comment, testimony, and one or more written briefs available to the legislative, judicial and executive branches of state government, to the interested promoters of the technology, and to the public. The mission would be performed within the limits of probity, competent science and responsible professionalism.

DISCUSSION

The council would be multidisciplinary. It would be composed from the University staff in the social, physical, and biological sciences; law and medicine. The selection would be made toward the sole end of effectively accomplishing the mission and would be the responsibility of the University President.

The choice of eight to twelve members is deliberate. A group of this size could be sufficiently multidisciplinary to provide the broader basis of consideration that would be required, and it would be large enough to be functionally effective. However, the group would be small enough so that the internal politics and inertial behavior of larger organizations could be avoided.

There would be no new departmental structures associated with the institutions; members would remain attached to their departments. Secretarial, informational, computational and travel support would be provided as necessary and administered through the President's office. Appointment would in no way prejudice the academic standing of members, which is not to say, however, that professional incompetence demonstrated in the function of the institution would not detract from a member's good name.

For obvious practical reasons, it would be desirable to make some use of student competence. If sponsored by a member a student

could serve as technical support staff to the council. His funding would be administered by the President's office, and the sponsor would assume responsibility for the student's work. The relationship of a student's work with his academic program would have to evolve as an academic policy of the University.

The council would be funded through usual University channels. The individual members would not be responsible for obtaining grant money for work explicit to the mission, nor would they have the power to decide on the distribution of grant money to others. They could continue personal research or teaching only if it would not interfere with performance of their duties as council members. The membership would have discretionary powers over such matters.

Appointments would run three to five years, which would be long enough to acquire functional competence in the institution and long enough for significant accomplishment, but not so long that the term would be appealing as a potential sinecure. An individual would be limited to a single consecutive term of appointment in the belief that this would maintain diversity and vitality.

Not to the exception of University policy, cause for removal of a member would be technical incompetence, unprofessional conduct, or unproductivity in any combination and degree such that the effective accomplishment of the mission would be prejudiced.

Should circumstances of demand or efficiency require it, the University President could appoint a second council, disjoint from the first.[1] While the second would be aware of the

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[1]The existence of councils at the University would not preclude their independent establishment elsewhere in the State's academic community.

activities of the first, and while they both would utilize the same support facilities, the groups would remain functionally independent. In the event of overlapping interest between groups, the overlap would be acceptable; diversity and pluralism in assessment is judged to be more important than efficiency.

There are reasons for the association of such an institution with the University. The University has staff with the necessary competence, it has the necessary administrative and informational support, and it has associations of prestige and credibility. As an apolitical institution, it offers considerable insulation from political stress, and yet at the state level it has sufficient access to public and government to accomplish its purpose. Further, the University offers the necessary financial insularity, the funding being independent of the corporate or bureaucratic entities which would be affected by adversary arguments.

The establishment of such an institution should not prejudice the University's apolitical stance since, in effect, the University is being given an abstract responsibility to society similar to that of a court-appointed counsel. As a duty, it in no way would imply a moral or political advocacy on the part of the University or the council members. The association of the institution with the University would be a practical decision and obviously not one based on University opposition to technologies, in particular or in general.

Assuming that the creation and performance of an adversary group is a legitimate University function, then it is logical that the responsibility for that group would reside with the chief administrative executive of the University, the President.

The primary mandate of the council would be to define an adversary position on the implications of some technologies which they consider of primary significance to the future social and natural character of the state. Functionally, this would have two aspects: first, to sort and fix priorities so that the significant technologies can be identified, and then to select specific technologies and to prepare an adversary brief on them.

To perform the first part of the mission, it is necessary to be conversant in the whole spectrum of anticipated technological change. To this end, various interfaces must be maintained with professional bodies representative of technology, state agencies, and public or private groups having similar interests in technology.

Future effects from technological change can arise from three distinct situations: a new technology, growth of an existing technology, or the expressions of the latent effects of a previously established technology. There is no reason to exclude any of these cases from consideration; however, it should be recognized that in a practical sense the first is the simplest to address since it avoids involvement with the economic inertia, psychological conventions, and existing supporting institutions associated with an established technology.

Some instances of change in our society have limited relationship with a specific technology. A change in credit structure, for example, might influence society without involving innovation or

growth of a technology. Such situations would be outside of the legitimate concern of the adversary council.

Most technologies would not be unique to state boundaries but would have a similar relevance on a regional and national scale. This should not dissuade the group from addressing these technologies when it concludes that in so doing it would best serve to fulfill its responsibilities.

Definition of priorities would be determined internally. This would avoid the situation in which the institution becomes an extension of some governmental agency's staff, or in which the effectiveness of the institution is emasculated by saturation with trivia. In its assignment of priorities, the group should endeavor to make an equitable inclusion of competing technologies wherever an assessment of one is contemplated.

A public docket would be maintained showing those technologies which the group anticipates addressing within some prescribed time. For these technologies, one or more adversary briefs would be prepared and made available to the legislative, executive and judicial branches of the state government. Similarly, the public would have access to this material as should interested parties for the technologies in question. The members would also be available for comment after a particular technology has been introduced into the docket. Councils would be expected to present their adversary position before such governmental hearings as were deemed appropriate.

The brief would, as is pertinent to a particular technology, evaluate nonbeneficial implications to the social and natural world, describe the envelope of possible developments consistent with pre-

sent knowledge of the technology, suggest which social or natural quantities should be monitored to best characterize the impact of the technology as it evolves, and indicate any segments of scientific knowledge so defective or incomplete that resolution of the scientific uncertainties would substantially simplify the assessment of the technology. Alternatives should be defined and criticized comparatively; anticipated change should be carefully characterized as to its correctable and irreversible aspects; and the relationship between change and supportive social institutions should be discussed as to the adequacy of existing supporting institutions and the nature of new ones likely to evolve consequent to the technology.

It is important to understand that no presumption of exhaustive predictive capacity would be made for specific technologies; what is suggested is that with our society's genius for codifying experience and information, and with our species' characteristic of abstract thought, our society should be able to usefully anticipate the implications in its technologies and, by appreciating these implications, to more reasonably direct technology to the needs and purposes of society.

Furthermore, a technology assessment group would make no pretense of considering all relevant technologies.

It should also be explicitly understood that the council would have no decisional power, or obligation, on the innovation or expansion of a given technology; this power lies with the branches of government and ultimately with the electorate, insofar as it is assumed by them. Neither is there any

intention that the council would give other than descriptive exposition on matters involving moral or social value judgments, such as the assignment among society of a technology's responsibilities for its uncertainties and its external costs.

The justification for the group's responsibility is that it would explicitly address the defect of promotional bias. Furthermore, this would be accomplished by the creation of a scientifically competent body of contrary bias and without the dangers to be expected from the formation of an agency of conjectured evaluative omnipotence. The public controversy that would be inherent in the mission would lead to a healthy competition of ideas and would only damage the image of the technology insofar as criticisms would prove justified and uncertainties would be left unresolved. Since the adversary arguments would be much concerned with long-term and secondary implications, corporate and bureaucratic interests in assessment must similarly increase in their extent if their own judgments are not to seem superficial. An open controversy would serve to attract public attention and would give many sectors of society who are presently alienated from decision-making a place to see their interests mentioned.

Note that the council would be sustained by an abstract responsibility which in no way presupposes a moral commitment. In this sense, the group would have an obligation similar to that of a court-appointed counsel. The demonstrated moral impotence of the technical sector of society would suggest that absence of personal belief is no major impasse to an effective advocacy of a technical point of view.

In a society of increasing affluence, it is reasonable to expect a more general interest in the decisions involving technological change. This interest will naturally gravitate toward areas of neglected concern, such as secondary implications. Sporadic controversy with an annoyed or aroused populous can be damaging and costly to the promoter of a technology. As constituted, an assessment institution would allow these implications to be examined publicly in a more exhaustive and orderly manner. Industry and agency could then anticipate an orderly confrontation and prepare accordingly. It would be difficult to argue that Northern States Power Company's present situation would be less desirable if they had been confronted periodically by the council over the past five years.

Similarly, an orderly and responsible confrontation over technological change could not help but improve the strained situation in which an old technology with its vested interest would be in opposition to a competitive new one.

Technology has conferred on us our way of life. As a catalyst of change, it has become the implement of economic and governmental power. In this climate of aggressive change society is vaguely coming to realize that something must be done to assure that technology confers on us a way of life which we can accept.

The universities are unique in having the existing potential of information and trained intelligence to address the problem. Government and electorate should, and probably do, look to the universities for a solution. If universities cannot respond to

this expectation and need, then the problem will be taken elsewhere to the probable detriment of universities and society alike.

What is proposed here is an accessible approach to the problem. In measures of power, the stature of the University would be increased by the proposed responsibility, but the choice of the University as a medium for that responsibility is practical rather than political. Furthermore, the power principally attaches apolitically to the responsibilities of the council rather than politically to its members. As such, it should be less than an anathema to those in positions of power; at the same time it has promise of significant effect.

The proposal has no pretensions of being an exhaustive solution; what it does purport to be is a minimally disruptive step designed to correct a defect in our society's anticipatory perception. What society does with its increased perception is something that must evolve.

ALTERNATIVES TO A UNIVERSITY TECHNOLOGY ASSESSMENT COUNCIL

An Institute Separate from the University, But Otherwise Having a Similar Mission to the Council

This appears unnecessary at the state level where the existence of the staff and support facilities of a major university provide a greater flexibility in an already existing institution. Appointment and maintenance of staff would be more difficult. Lack of existing facilities would delay implementation. State endowment seems politically less accessible; and since even a minimal adversary group would require substantial yearly funding, it is difficult to conceive where, in the private sector at the state level, such a continuing source of money would be available.

An alternative to state endowment would be legislative appropriation. The latter mechanism with its implied bi-annual review of programs, both current and proposed, would be inconsistent with the effective function of the adversary group.

Some advantage might attach to a more insulated basis of funding, such as state or private endowment. Also, avoiding the established complexities of university function could have appreciable advantage.

To Place the Burden of Comprehensive Assessment on the Promoters of the Technology

This would be an unhealthy arrangement because the promoter would establish some control over the funding of the assessment which, in turn, would erode the credibility of the conclusions. In addition, it would be a less public means of function and would, therefore, be less successful in focusing social attention on a broader basis of technological judgments.

Since this added expense would accrue to the innovator, the evaluative procedure would be administratively complex. Most important, it would be overly suppressive of technology and would act to the especial detriment of the small industry.

A State Commission or Agency to Evaluate *the Overall Merits Of Technologies*

Such an institution would suffer from major shortcomings. It would be a bureaucracy of enormous power and as such would be subjected to severe pressures. The possibility exists that such a group could be manipulated in its judgments by representatives of the various technologies which it was expected to evaluate. Because of its relationship with political and industrial power, it would likely be subject to the same decisional defects which it was designed to correct. Further, there would be problems in acquiring the caliber of scientific staff required. The complexity of the technological effects and their involvement with society do not suit themselves to consideration by a monolithic institution of implied evaluative omnipotence. More pluralism, more public interaction is advisable.

SECTION THREE

PROPOSAL FOR A SYSTEM OF

STATE OF MINNESOTA

DATA BANKS FOR ENVIRONMENTAL INFORMATION

SECTION THREE

ABSTRACT

This proposal is based on the observations that there is insufficient data for environmental control planning, that in cases when data are available they are frequently inaccessible, and that the data needed by an enforcement agency are not identical to those needed by a planning or research group. Effective natural resource and health planning requires a consideration of the long-range effects of existing and new technologies on our state's economic and social goals and environmental quality. To this end, it is necessary to maintain a capability to undertake timely analysis so as to provide early warning to governmental agencies and the general public of environmental and health hazards and of economic and social costs. The proposed technology assessment council (Section Two of this report) addresses a segment of these requirements; however, a systematic and thorough collection of data relating to the environment is necessary not only to the functioning of the council but also to any environmental planning.

For these reasons, it is proposed that the Minnesota State Planning Agency expand its data gathering activities and assume the responsibility of coordinating all such activities as they relate to natural resource and health planning.

PROPOSAL

It is proposed that the Minnesota State Planning Agency assume the responsibility of serving as a central state coordinator of all information and data relating to the environment. In order to carry out this function, it will be necessary for the Agency to collect and receive all such information and data from all sources, both governmental and private.

It is recognized that certain State agencies are currently collecting such data or are organizing such data in a way as to make it generally accessible. Furthermore, the State Planning Agency has, in several instances, been instrumental in the development of these efforts. This proposal is addressed to an expansion of these activities.

The proposed data system must be structured in such a way as to assure maximum compatability between the various elements of the system and to make maximum use of the various physical components of existing and proposed systems. Among the functions of the State Planning Agency should be the critical review of existing and proposed monitoring systems with the aims of eliminating any duplication which now exists, initiating monitoring of parameters not now being measured, and assuring that the resulting data are useful not only for enforcement purposes, but also for planning.

To this end, it is suggested that an effective environmental data system requires mandatory reporting of all discharges of wastes into the environment from whatever source. Such emissions inventories do not now exist; it is recommended that legislation be prepared which would remedy this deficiency.

MONITORING, STANDARDS AND DATA BANKS

Throughout the history of dealing with environmental questions, the inadequacy of monitoring and the inaccessibility of data are prominant faults. These data, or a substantial subset of them, are needed in connection with several types of activities: legislative, enforcement or regulatory, public and corporate planning, and research, including technology assessment.

These groups do not have identical needs although there is considerable overlap. A regulatory agency requires current monitoring and discharge data which are organized such that they are accessible for enforcement purposes. Such an agency, for example the Minnesota Pollution Control Agency, is not primarily concerned with the monitoring results of the distant past nor with projections far into the future.

On the other hand, research and planning activities require ready access to the data of the present and the past. It is necessary that data is available for all pollutants, even though there might be no regulatory need for some of them at the time when the records are made. Researchers and planners are interested in trends, in rates of change, and in discontinuities.

A data base is possible only if there has been reliable monitoring. The extent and type of monitoring depends on the nature of the standards, the enthusiasm of the agency involved, and the purpose of the monitoring program.

Monitoring for planning purposes is a much more laborious and sophisticated task than monitoring for enforcement. Here we are

trying to feel the current pulse of the environment, chart its variations in space and time, and make rational predictions of the effect of new activities and the passage of time on environmental quality. Such monitoring obviously is substantially different from regulatory monitoring.

One of the fundamental aspects of monitoring for planning, and for setting and reviewing ambient standards, is the great breadth of the investigation. Investigating one or a few pollutants and their associated environmental changes in space and time is not sufficient. A few observations made in one place and then, later, in another place are of little use for planning although they may have substantial regulatory utility. The monitoring must be stable in location, long in time, and must attempt to assess all aspects of the natural environment. Locational stability and substantial record length are necessary to insure the statistical stability of the parameters being monitored. We are all aware of the inherent stability of healthy natural systems. But this is not static stability; the system parameters are not nearly constant with time. Rather, healthy natural systems are more commonly dynamically stable. In dynamically stable systems, large fluctuations may occur but the feedback mechanisms eventually return the system to its expected state. Thus, our monitoring program must be sufficiently stable in space and long enough in time to accurately reflect the usual vagaries of nature. This is particularly important since in planning, including setting or changing ambient standards, the <u>maximum</u> effect of a perturbation superimposed by man on the natural system must be assessed. To effectively plan, we must know the degree to

which a natural system will be disturbed by a particular human activity. Very often, the exact magnitude of the effect induced by man is known, but no one has any idea of the natural variability. It is, however, the combined situation which must be assessed.

The density of monitoring in space and time is also critical. It is not possible to give specific guidelines without further study, but research projects to determine the density requirements should be initiated soon and, in any case, well in advance of establishing any monitoring network. It is likely that the necessary research will have to investigate several variables. These include: gradients of natural systems in space, diurnal and seasonal changes, the influence of topography, and coherence of the parameters.

There are many reasons for stressing the necessity for monitoring the total natural environment. First, there are the well known interrelationships of natural systems. A change in one portion a priori means a change of some magnitude in another portion of the system. Clearly, the direction and magnitude of the secondary changes must be part of the planning decision. It will be difficult and expensive to establish a comprehensive monitoring system. Many parameters which appear to be unrelated or which lack obvious importance will have to be included because of the possibility of unrecognized interrelationships. Recent experience seems to be telling us that adequate planning for the introduction of new or additional human activities must attempt to predict significant interrelationships and their consequences.

Investigation into the synergistic effects of environmental contaminants on environmental and human health is among the critical

research needs of today. There is considerable speculation that the effect of many poisons and irritants combined is substantially greater than the sum of their individual effects, especially when the individual dosages are well below "safe" levels. It seems apparent that important planning and ambient standard setting questions are involved here. In planning, those activities which combine to increase environmental damage must be kept sufficiently separated. In other words, the proper mix of activities to minimize environmental damage must be sought. In a similar manner, ambient standards should be evaluated to minimize not only individual damage, but also damage resulting from physical and chemical interactions.

The above seems to indicate that two monitoring programs and data banks are needed. The first is an enforcement system for implementing emission standards such as the Minnesota Pollution Control Agency is developing. The second is an extensive data bank for planning purposes and for setting ambient quality standards. The State Planning Agency bank should strive to accumulate relevant data from other agencies, e.g., nitrate data from the State Department of Health. These data should then be integrated into a statewide file system such as the land use survey currently under way. Furthermore, measurements of substances and activities not presently monitored on a regular basis, e.g., mercury, asbestos, and pesticide residues, should be initiated. It is essential to have all of these data in similar file systems, if not in the same file, so that the time constant for planning can be shortened to approach that of exploitation.

These data would be of immense value. First, state and local planning groups would at last have a reasonable data base for decision-making. Second, ambient environmental quality standards could be set and changed on the basis of actual knowledge of "natural" concentrations (expected and variance values); more importantly, the ambient standards could be adjusted and emission standards changed to meet the time changes in environmental quality. Third, basic research people would have a firm baseline for their investigations into nature and its preservation. Fourth, the council proposed in Section Two of this report will need such an unbiased and readily available data source. Finally, the public could see, and hopefully appreciate, the results of planning and enforcement aimed at upgrading the quality of their natural environment and, not coincidentally, their own physical and mental well-being.

It should be emphasized that the setting of ambient environmental quality standards and the setting of emission standards are intrinsically different processes. The determination and specification of ambient standards, whether for air quality, water quality, land use, or such things as highway safety, is done by the public at large through the usual political mechanisms. Once these ambient standards have been developed, it is the function and responsibility of the regulatory agencies to translate them into operationally manageable regulations. In the case of air and water pollution, these regulations commonly take the form of emission standards.

It should be obvious, however, that both the ambient standards and the emission standards change with time. We are now in a period of rapidly changing ambient environmental quality standards. The

public is indicating its displeasure with environmental conditions and have demanded change. The emission standards would have to be changed to accommodate the changing ambient standards even if there were no growth. Growth itself, even if ambient standards were completely stable, requires continual revision of emission standards.

A simple example will serve to illustrate the need for increasingly stringent emission standards in a growth economy. Given the situation of a river receiving municipal wastes, and the political decision that the water quality in that river shall not be further lowered: if the municipalities along that river experience either population or industrial growth, the only choices are to continue with the same emission standards for the waste treatment facilities, with the result that the water quality is lowered, or to tighten the emission standards.

The role of a regulatory agency is to translate ambient standards into emission standards and to enforce those standards. The role of the public at large is to determine the desired ambient environmental quality standards. The role of a planning agency is to anticipate changes, technological or otherwise, and to so modulate it as to be consistent with environmental and health policy. All of these functions require ready access to environmental data.

The necessary data are not presently available. In some instances no monitoring has been done, in others existing data is filed in such a way as to make it unusable, and in still other cases wastes are not recognized as constituting either an environmental or a health hazard.

The case of nitrate levels in underground aquifers illustrates the situation where the necessary monitoring has been done but the records are in such condition as to minimize their usefulness.

Nitrate determinations in underground water have been made for many years; however, the results are filed and kept in such a form as to permit neither spatial nor temporal comparisons. Data of this type can be made accessible by a suitably designed electronic data system.

The case of mercury pollution illustrates a very serious situation. Mercury has been recognized as a toxin for hundreds of years; it is known to have been used in such copious quantities, and in such a manner, as to make environmental releases probable; mercury contamination, resulting in public health concern, has been recognized in Japan and Scandinavia for more than a decade; and yet, there were no data on environmental releases or levels in Minnesota until recent months. Situations of this type might well be avoided if emission data were readily available, and if researchers and public agencies were conditioned to attempt to anticipate rather than to react. The mercury situation clearly represents an example where the entire public health mechanism has failed. We cannot afford to place our reliance on the existing system and thus risk other such situations.

Several data systems are presently being developed by State agencies. The Minnesota Pollution Control Agency has initiated data systems for river and air quality data and has access to a more ambitious federal system, STORET; the State Department of Health has computerized certain vital statistics records of the past decade and has begun a system for dealing with municipal water quality data; and the Minnesota State Planning Agency is sponsoring a data bank for land use information and has completed a lake-shore inventory.

To assure maximum compatibility between these and all future systems, over-all coordination through a central agency is necessary. Because the most stringent demands made on such systems are for planning, and because of its central executive position and charter, it seems appropriate that the State Planning Agency should assume this responsibility.

SECTION FOUR

THE ENVIRONMENTAL MANAGEMENT SEMINAR

AND SUMMER STUDY GROUP

SECTION FOUR

SUMMARY OF THE SEMINAR AND SUMMER STUDY

The Minnesota State Planning Agency's Health and Natural Resources Planning Groups cooperatively supported a seminar and summer study at the University of Minnesota during the 1969-1970 school year. The seminar, the Environmental Management Study Group, was organized through the University's Center for Urban and Regional Affairs. Seminar participants included faculty members and students from several departments and collegiate units of the University and members of the State Planning Agency staff.

The objective of the seminar was to explore the condition of Minnesota's physical environment and to develop recommendations for environmental control in the State of Minnesota. Throughout the seminar attempts were made to evaluate the quality of Minnesota's environments with an emphasis on human health, natural resource utilization, and factors which contribute to environmental change.

Participation of faculty members and students from diverse disciplines together with the joint sponsorship of the Natural Resource and Health Planning staffs of the State Planning Agency were responsible both for the wide range of topics considered

and for the failure of the seminar to reach unanimous conclusions. The conflicting philosophies toward planning, environmental control, natural resource utilization, and health were frequently apparent and served to emphasize the diverse attitudes of society toward our physical environment.

If the seminar participants were in agreement on any point, it was that rational planning--including an assessment of economic, environmental, health, social and other implications of both policy and technology--is necessary as is the elimination of the presently fragmented and uncoordinated management of resources. Minnesota's resource policy, although unwritten, seems to reflect the aspirations of the 1800's, primarily exploitation. Although the seminar members could not reach unanimous consent regarding a new policy, the need for an examination of present practice was repeatedly emphasized.

During the fall quarter of the 1969-1970 school year, the full seminar met weekly for presentation and discussion of papers. During the winter and spring terms, the graduate assistants met regularly with the State Planning Agency staff to assemble and review the documentation available and to prepare papers. Also, the entire seminar assembled several times during the spring quarter to discuss new topics or to reconsider subjects considered earlier in the year.

It was the intent of the seminar to conclude with a report setting forth its deliberations together with the papers which were prepared by the participants. It soon became clear, however, that this was not practical in large part because of the diversity of

opinions and material presented during the course of the year and also because of the nature of the written reports.

During the summer of 1970, a small working group was formed to consider the results of the seminar, gather other related data, suggest recommendations, and prepare this report. This group consisted of Steven Emmings and Mark Heitlinger, both students at the University of Minnesota, and Dean E. Abrahamson, a member of the seminar faculty. Donald P. Geesaman served as consultant to the group and formulated the recommendation for the technology assessment council. Richard Skaggs chaired a faculty advisory committee to the working group and actively participated in the preparation of this report. The faculty advisory group included Professors Conrad Straub, Richard Skok, John Borchert, Roy Rickson, and John Waelti, in addition to Richard Skaggs. Ms. Julie Adleman must be gratefully acknowledged for patiently enduring numerous drafts and re-drafts.

MEMBERS OF THE CURA/SPA ENVIRONMENTAL MANAGEMENT SEMINAR

Faculty & Invited Speakers	Department
Dean Abrahamson	Anatomy and Laboratory Medicine
Russell Adams	Soils Science
Robert Angellotti	U.S. Public Health Service
Richard Bond	Environmental Health
Alan Brook	Ecology & Behavioral Biology
Robert Crew	Political Science
Eville Gorham	College of Biological Sciences
Robert Holt	North Central Conservation Research Center
Lee Martin	Agricultural and Applied Econ.
Roger Martin	Landscape Architecture
Roy Rickson	Sociology
James Serrin	Mathematics
Richard Skaggs	Geography
Richard Skok	Forestry
Robert Somer	University of California, Davis
John Waelti	Agricultural and Applied Econ.
Kenneth Whitby	Mechanical Engineering

Graduate Students*	Department
Arnold Alanen	Geography
Hong Ik Chung	Sociology
Weston Fisher	Ecology/Behavioral Biology
Joseph Kukla	Environmental Health
Marlys McPherson	Political Science
Kenneth Menz	Agricultural and Applied Econ.
David G. Nelson	Forestry
James Robin	Landscape Architecture
Kenard Smith	Geography
Dorothy Tether	Geography
James Yanko	Ecology

State Planning Agency Staff in Regular Attendance

David Hammernick
R. E. MacStravic

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*These students were formally associated with the seminar as half-time research assistants or as students registered for credit. Many other students attended the seminar, some on occasion and some on a regular basis.

ENVIRONMENTAL MANAGEMENT SEMINAR

Topics for Fall Quarter 1969

Topic	Speaker
Part I--Institutional Setting of Environmental Management--National, State, Local Scales	
1. Economic setting	Lee Martin
2. Political setting	Robert Crew
3. Social setting	Roy Rickson
4. Public Health and Preventive Medical Services System	Richard Bond
5. Aesthetics and Environmental Management	Roger Martin
Part II--Minnesota Resources and Issues	
6. Air Pollution--Weather Modification	Richard Skaggs
7. Forests and Forest Watersheds	Richard Skok
8. Insecticides and Pesticides	Alan Brook
9. Smelters--in the Wilderness or the City	Eville Gorham
10. Radioactivity	Dean Abrahamson
11. Synopsis	All

ENVIRONMENTAL MANAGEMENT SEMINAR

Topics for Spring Quarter 1970

Topic	Speaker & Affiliation*
1. Particulate Pollution in the Atmosphere: Problems of Measurement, Definition, Evaluation	Kenneth Whitby (Mechanical Engineering & Los Angeles Basin Study)
2. Fertilizer Runoff	Robert Holt (Director, North Central Soil Conservation Research Center)
3. Pesticides and Insecticide Residuals	Russell S. Adams (Soils)
4. Food Supplies and Environmental Health	Robert Angellotti (U.S. Public Health Service)
5. Personal Space	Robert Somer (Psychology, University of California, Davis)
6. Factors in Industry Adoption of Pollution Abatement Measures: Preliminary Findings	Roy Rickson (Sociology)
7. Noise Pollution	James Serrin (Mathematics)
8. Report to the State Planning Agency: Organization, Content, Limitations	

*University of Minnesota unless otherwise noted.

ABSTRACTS OF PAPERS SUBMITTED

The following reports were submitted by the paid research assistants and/or their faculty advisors. Copies of the reports were submitted to the Minnesota State Planning Agency and are available in their offices.

Hong Ik Chung [Professor Roy Rickson]

Report titled *Self-Interest and Pollution Control*, by Roy E. Rickson with the assistance of H. I. Chung. Work done in connection with Professor Charles Ramsey, Department of Sociology. The basic hypothesis is "we cannot impinge less upon the physical environment, but we must exert more control over our physical surroundings." Later, it states "the basis of environmental quality is, therefore, to be found in our ability to conceptualize the kind of environment we want and direct organized efforts toward that end." The report is a summary of a survey conducted upon 485 high school seniors from three different schools. The students were asked to respond to a set of questionnaire items about pollution. The final part of the report, titled *Implications*, states that "self-interest, as we have defined it, does not shape the responses of high school seniors to facts and policy recommendations about pollution."

Wes Fisher [Professor Allen Brook]

The No-Deposit No-Return Beverage Container: estimates, without documentation, the economic costs of the use of NR containers to Minnesotans and briefly discusses non-economic aspects of their use; concludes that their use should be discontinued; proposes that the MPCA should establish a recycling division.

The Feedlot Problem: in two pages estimates the amount of waste from cattle on feedlots and makes recommendations to state agencies for control; attaches xeroxed materials (which include a bibliography and an overview of the problem) from some unidentified source.

Wes Fisher [Prof. Allen Brook] - continued

The Role of the SPA, the Department of Conservation and the MPCA in Recommending Population Stabilization by 1985: recommendation running 1/2 page which concludes that Minnesota must consider world-wide population trends and effects and examine the effect of an increased population on the state's recreational assets and scenic beauty; attaches a second 1/2 page proposal on human wastes disposal.

Joseph Kukla [Professor Richard Bond]

Directory of Responsible State Agencies, Research and Basic Scientific References at the U of M, in the Area Specialty of Nutrition: concentrates on nutrition--outlines objectives, programs, and responsibilities of state agencies; provides bibliography with abstracts of nutrition literature; lists degree candidates at the U of M with their thesis subject or specialty in the field; lists U of M staff and their specialty areas and relevant publications.

Marlys McPherson [Professor Robert Crew]

No report was submitted.

Kenneth Menz [Professor Lee Martin]

A Report on Sewage, Animal Wastes, Chemicals and Water Pollution in Recreational Areas: bibliographies seem to include only reports originating in Minnesota and does not include review articles summarizing the total situation; also a short report dated January, 1969, *State Program and Operations Manual, State of Minnesota*, is included which appears to tabulate the state agencies involved with various aspects of water use including pollution.

Professor Martin submitted a paper, *Environmental Quality and Environmental Quality Control--Economic Setting and Some Economic Aspects*, at the time of his seminar during the fall quarter. This paper discusses economic implications of environmental quality problems and proposes the use of variable standards and economic incentives to improve the quality of the environment. The author, dissatisfied with common systems of classifying environmental quality problems, proposes a new framework for classifying problems which he considers to be of greater analytical usefulness.

Dave Nelson [Professor Richard Skok]

Copy of short summary of the number of acres treated with pesticides or herbicides in Minnesota in 1969; a copy of the proposed rules and regulations of the Minnesota Department of Agriculture relating to pesticides; copy of a summary prepared by the Minnesota and U.S. Departments of Agriculture, Crop and Livestock Reporting Service, on pesticides used on farms in 1969--Five Great Lakes States; and a copy of a report entitled *Preliminary Report of Pesticide Use on Minnesota Farms for Specified Crops--1969* by the Crop and Livestock Reporting Service of Minnesota and the U.S. Department of Agriculture.

Ken Smith [Professor Richard Skaggs)

Weather Modification: deals with purposeful weather modification, its methods, effects and dangers; looks at ecological, political and economic considerations and social consequences; makes specific recommendations for state action in this area.

Inadvertant Weather Modification: review of recent work in air pollution which stresses the idea that pollution control planning exclusively on a local scale is ineffective because air pollution is a phenomenon of global scale.

Current Listing of Air Pollution Research: brief outline of state activities and list of pertinent publications of University staff members; attaches bibliography of air cleaning and particles technology publications which were authored by the University's Mechanical Engineering Department.

Dorothy Tether [Professor Roger Martin]

Noise and Man in an Urbanized Environment: discusses noise, its sources, and its physiological and psychological effects; briefly suggests role planning can play in noise abatement.

James Yanko [Professor Dean Abrahamson]

Includes: a short summary of the literature relating to radiation effects, a summary of investigators at the U of M having interest in the problem of radiation exposure and radionuclide release, a summary of the regulations--existing and proposed--by the State Department of Health and the MPCA; listing of known users of radionuclides in the State of Minnesota--does not include quantities of radionuclides being released or available for release; bibliography of papers and reports relevant to problems associated with radioactive wastes from reactors and from other sources.

The following reports were prepared after the conclusion of the Seminar. They have been submitted to the Minnesota State Planning Agency and are available in their offices.

Steven Emmings

Air Pollution and Minnesota. This paper discusses the general notion of air quality standards, relates basic information on major sources and effects of air pollution, and describes surveillance and control activities at various governmental levels. The Minnesota situation is emphasized whenever possible.

The Snowmobile and the All Terrain Vehicle: Reactive vs. Anticipatory Regulation: paper maintains that problems attendant to the rapid growth of snowmobiling as a recreational sport were, for the most part, foreseeable; careful consideration of the nature of the vehicle would have revealed most of the basic problems addressed by ensuing regulations. Author maintains that this experience should be applied to a new and similar rapid growth technology, the all terrain vehicle. Paper concludes that anticipatory regulation is feasible and preferable to the reactive type of regulation demonstrated in the case of the snowmobile.

Mark Heitlinger

Minnesota's Environment: Exploitation, Productivity, and Environmental Quality. Exploitation of Minnesota's environment began with the early fur trade and progressed with the development of agriculture, forestry, and mining. Decreasing productivity became apparent about 1910 and a crisis in environmental quality is upon the state now. Causes and interrelations are discussed. The role of exploitation and biased decision-making are stressed.

Water Pollution and Minnesota: paper discusses water quality standards in general and their short-comings, the problem in defining water quality, a description of water's role in the natural and human environment, and the types of water pollution problems present in Minnesota. An attempt is made to list some potential pollutants and environmental indicators, their sources and effects. Surveillance and control are briefly discussed and some recommendations are presented for maintaining water quality in the state.